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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/601,958	08/10/2000	JYOTI KIRON BHARDWAJ	WLJ.056	5262
20987	7590	11/08/2004	EXAMINER	
VOLENTINE FRANCOS, & WHITT PLLC ONE FREEDOM SQUARE 11951 FREEDOM DRIVE SUITE 1260 RESTON, VA 20190			HASSANZADEH, PARVIZ	
			ART UNIT	PAPER NUMBER
			1763	

DATE MAILED: 11/08/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/601,958

Applicant(s)

BHARDWAJ ET AL. A

Examiner

Parviz Hassanzadeh

Art Unit

1763

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 27 September 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1,3-6,8-24 and 29-49 is/are pending in the application.
- 4a) Of the above claim(s) 3,5,10,11,16-20,22-24 and 29-49 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,4,6,8,9,12-15 and 21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 August 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

## DETAILED ACTION

### *Election/Restrictions*

Applicant's election without traverse of Species 1, Group 1, claims 1, 2, 4, 6-9, 12-15, 21 and 26-28 in Paper No. 12 is acknowledged.

Claims 3, 5, 10, 11, 16-20, 22-24 and 29-49 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected Species and method, there being no allowable generic or linking claim. Election was made **without** traverse in Paper No. 12.

It is also noted that claim 2, 7, 25-28 and 50 have been cancelled in the Amendment filed on 9/27/04.

### *Claim Objections*

Claims 8 and 9 are objected to because of the following informalities: it is suggested to correct the dependency of claims since claim 7 is canceled. Appropriate correction is required.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

**Claims 1, 4, 6, 8, 9, 12, 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bhardwaj et al (EP 0822582 A2) in view of Ohkawa et al (EP 0831516 A2).**

Bhardwaj et al teach a plasma processing apparatus (Fig. 1) comprising:

a vacuum chamber 11 having a support 12 for a substrate 13;

a gas inlet port 18 into the chamber through which deposition or etching gases can be introduced;

wherein the alternating reactive ion etching and depositing a passivation layer by chemical vapor deposition is performed, wherein one or more of the following parameters: gas flow rates, chamber pressure, plasma power, substrate bias, etch rate, deposition rate, cycle time and etching/deposition ratio vary with time (*means for alternately and repeatedly introducing an etch gas and a deposition gas into the chamber through the at least one gas inlet, wherein the deposition gas is different from the etch gas, wherein the deposition gas is for the deposition step of each cycle in which a passivation layer is deposited on the substrate and the etch gas is the etch step of each cycle in which the passivation is selectively removed*);

an RF source 16 coupled to the coil 15a (*means for striking a plasma into the etch and the deposition gas alternately introduced into the chamber*); and

a plasma bias which can be either RF or DC can be connected to the support electrode 12 so as to influence the passage of ions from the plasma down on to the wafer 13 (*means for accelerating the available ions onto the substrate*) (abstract, page 3, line 49 through page 4, line 17).

Bhardwaj et al fail to teach attenuation means for partially reducing the ion flux from the plasma so that sufficient ions are available to selectively remove the passivation layer during the etch step of each cycle.

Ohkawa et al teach a plasma processing apparatus (Fig. 1) including a magnet 30 generating magnetic field parallel to the surface of the substrate for insulating the substrate 26 from free electrons in the plasma. By applying appropriate potential on the substrate or an inside electrode 40, ion etching/deposition or neutral etching processes, respectively, can be performed (column 7, line 46 through column 8, line 2; and abstract and column 6, line 19 through column 8, line 2).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to implement the magnetic field generating device as taught by Ohkawa et al in the apparatus of Bhardwaj et al in order to insulate the substrate from free electrons in the plasma.

Further regarding claim 1: the magnetic field as taught by Ohkawa et al removes electrons from plasma region towards the chamber sidewall. This magnetic field would inherently cause some of the plasma ions to be attracted towards the wall and thus cause a partial reduction in the plasma ion density (see also page 19 of the present application).

*Regarding claim 4:* the side wall of the chamber in inductively coupled plasma source are known to be made of a dielectric material such as quartz, for example, the vessel 12 is made of an insulating material (dielectric material) such as glass (column 6, lines 19-31).

*Regarding claim 6:* as shown in Fig. 1 of Bhardwaj et al, the inductive antenna 15a is disposed around the chamber 11.

*Regarding claim 8, 9, 12, 21:* the magnetic field as taught by Ohkawa et al may be produced by a permanent magnet or an electro-magnetic device (column 7, lines 2-16).

**Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bhardwaj et al (EP 0822582 A2) in view of Ohkawa et al (EP 0831516 A2) as applied to claims 1, 4, 6, 8, 9, 12, 21 above, and further in view of Kin (JP61-39521 A).**

Bhardwaj et al in view of Ohkawa et al teach all limitations of the claim as discussed above except for the attenuation means (magnetic generating filed) comprising a tubular member carrying magnets.

Kin teaches a plasma processing apparatus including a pole-like electrode 101 having a plurality of magnets 103, 104, ... embedded therein wherein the electrode is inserted inside a plasma chamber 110 (abstract).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to implement the magnetic arrangement as taught by Kin in the apparatus of Bhardwaj et al in view of Ohkawa et al in order to protect the magnets from plasma when the magnetic field generating device is disposed inside the plasma chamber.

**Claims 14, 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bhardwaj et al (EP 0822582 A2) in view of Ohkawa et al (EP 0831516 A2) as applied to claims 1, 4, 6, 8, 9, 12, 21 above, and further in view of Ribeiro (US Patent No. 4,769,101).**

Bhardwaj et al in view of Ohkawa et al teach all limitations of the claims as discussed above except for the attenuation means (magnetic generating filed) is temperature controlled.

Ribeiro teaches a plasma processing apparatus (Fig. 1) including a magnet coil 51 cooled by a cooling system 52 having a cooling-fluid line 53 (column 6, lines 22-33).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to implement cooling mechanism as taught by Ribeiro in the apparatus of Ohkawa et al in order to control the temperature of the magnets particularly if it is desired to dispose the magnets inside the chamber.

**Claims 14, 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bhardwaj et al (EP 0822582 A2) in view of Ohkawa et al (EP 0831516 A2) as applied to claims 1, 4, 6, 8, 9, 12, 21 above, and further in view of Maeno et al (US Patent No. 6,060,836).**

Bhardwaj et al in view of Ohkawa et al teach all limitations of the claims as discussed above except for the attenuation means (magnetic generating field) is temperature controlled.

Maeno et al teach a plasma processing apparatus (Fig. 1) including permanent magnets 40 cooled by a water-cooled structure comprising a cooling water passage (not shown) within the central conductor 22 in order to remove heat generated by plasma and thus to protect the magnets (column 5, lines 60-65).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to implement cooling mechanism as taught by Maeno et al in the apparatus of Bhardwaj et al in view of Ohkawa et al in order to remove heat from the magnets particularly if it is desired to dispose the magnets inside the chamber.

#### ***Response to Arguments***

Applicants assert that the ion trap of Ohkawa et al substantially removes all the ions from the plasma according to column 7, lines 46-51 of Ohkawa et al.

Examiner argues that Ohkawa et al teach a magnetic field creating device for creating a magnetic field with flux lines substantially parallel to the surface of the substrate to be processed. This particular orientation of the magnetic field insulates the substrate from free electrons in the plasma (column 7, line 46 through column 8, line 2). It is noticed that the magnetic field of Ohkawa et al is configured to insulates substrate from plasma free *electrons* not from plasma *ions* flux. The apparatus of Ohkawa et al is capable of used for ion etching or deposition as well as neutral etching process (abstract). The neutral etching process is achieved by applying appropriate voltage to an electrode disposed around the sidewall of the chamber to extract ions from the plasma (column 8, lines 3-20). The magnetic generating device creating a magnetic field in a direction such that plasma electrons are directed towards the chamber sidewall would inherently partially reduce the plasma ion flux.

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

*Tsubaki et al* (US Patent No. 5,647,944) and *Lee et al* (US Patent No. 5,968,275) teach a plasma reactor including a plasma distribution member disposed between a plasma region and process region wherein plasma ion flux is inherently partially reduced as ions pass through the distribution member.

*Lagarde et al* (US Patent No. 6,403,490 B1) teach a plasma reactor including a series of magnets disposed between two parallel electrodes for oscillating electrons between magnetic poles;



*Watanabe (JP 2-118055 A)* teach a plasma reactor including a magnet 11 cooled by a cooling mechanism as shown in Fig. 1; and

*Okudaira et al (US Patent No. 4,985,114)* teach an apparatus wherein alternately etching and deposition gases are introduced into a reaction chamber at predetermined time intervals.

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Parviz Hassanzadeh whose telephone number is (571)272-1435. The examiner can normally be reached on Tuesday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory Mills can be reached on (571)272-1439. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

*P. Hassanzadeh*  
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Primary Examiner  
Art Unit 1763

November 1, 2004